

COLSTRIP BN

ROSEBUD COUNTY

The Colstrip BN air monitoring site was established by the Montana Air Quality Bureau to measure concentrations of particulates, sulfur dioxide, and nitrogen dioxide in the air at Colstrip. The site was located approximately 2 miles southeast of Colstrip on top of an isolated hill at 45° 51' 30" N and 106° 34' 43" W (Site No. 109 on Map II-1). Elevation at the site was 3,575 feet.

The land in the area is hilly, with isolated steep-sided bluffs rising above the stream valleys. About 10 miles to the south, a steep escarpment rises abruptly to around 4,500 feet.

Although most of the land in the area is privately owned, a few scattered sections are controlled by the state and the Bureau of Land Management. The Northern Cheyenne Indian Reservation lies about 12 miles to the south.

Electrical power in the area is provided by the Montana Power Company and the Tongue River Electric Cooperative. Because Colstrip is a major electrical generation center, many electrical transmission lines cross the area.

Wind data were gathered at the site from January 1, 1975, to August 22, 1979. The wind recorder was a Meteorology Research, Inc., mechanical recording anemometer and wind vane located 4 meters above ground level. The data set consists of hourly averages of wind speed and wind direction. Data recovery was poor to fair, ranging from 11.3 percent in November to 78.2 percent in September. Overall data recovery was 39.5 percent.

Winds were monitored long enough, however, to represent the wind resource at this location. The data also are representative of other open, exposed, and elevated locations in the southern Rosebud County area.

Average annual wind speed at this site was 12.9 miles per hour. Average monthly speeds varied from 9.6 miles per hour in September to 16.8 miles per hour in February. The windiest months were January through April. The lowest wind speeds occurred during the months of July through September.

Average monthly wind power ranged from 205.7 watts/m² in July to 818.1 watts/m² in February. Average annual wind power was 453.6 watts/m².

Average seasonal wind speeds were 11.0 miles per hour in autumn, 11.3 miles per hour in summer, 13.6 miles per hour in spring, and 16.2 miles per hour in winter. The highest average wind speeds occurred during the mid-afternoon in spring and autumn, early evening in summer, and early morning and mid-afternoon in winter. The lowest average wind speeds occurred in early morning during the summer, in early evening during the autumn and winter, and in early morning and early evening during the spring.

The diurnal range of average wind speeds was greatest in spring and summer and least in winter.

The most common wind directions were west and west-northwest. Winds from the north-northeast and northeast were least common. By direction, average wind speeds varied from 8.6 miles per hour for winds blowing from the east-northeast to 17.2 miles per hour for westerly winds.

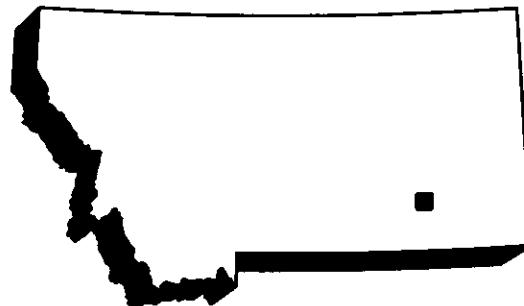


Table IV - 140
Monthly Wind Speed Distribution
ROSEBUD COUNTY - COLSTRIP BN

01/01/75 - 08/22/79

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	4.3	0.0	0.0	0.0	0.8	CALM
0.1-1.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	4.0	5.2	0.1	0.0	0.1	1.2	0.1- 0.4
1.1-2.0	0.4	0.3	0.6	0.2	0.2	0.2	0.4	5.0	6.1	0.5	0.0	1.5	1.7	0.5- 0.9
2.1-3.0	0.9	0.8	1.5	1.2	1.3	2.6	1.6	1.2	1.9	1.9	0.0	3.9	1.6	1.0- 1.3
3.1-4.0	1.4	1.8	2.1	2.4	4.2	5.7	3.7	1.7	3.1	3.7	1.2	4.2	3.1	1.4- 1.8
4.1-5.0	1.7	2.6	3.3	3.4	5.7	5.2	4.9	2.8	5.3	4.2	2.8	5.2	4.1	1.9- 2.2
5.1-6.0	3.3	3.2	5.3	2.2	5.8	5.8	7.9	4.3	6.1	4.5	3.4	6.4	5.1	2.3- 2.7
6.1-7.0	3.1	3.5	3.9	4.1	6.3	6.3	8.3	5.3	5.9	6.7	2.8	6.4	5.5	2.8- 3.1
7.1-8.0	2.9	3.3	5.7	3.6	6.2	5.3	6.4	6.3	6.8	5.9	4.0	5.3	5.5	3.2- 3.6
8.1-9.0	3.6	3.6	5.5	5.8	7.0	5.9	8.4	6.0	6.4	6.5	7.1	4.5	5.9	3.7- 4.0
9.1-10.0	4.0	4.1	5.7	6.3	6.2	7.1	8.7	6.1	7.3	6.4	4.9	4.5	6.1	4.1- 4.5
10.1-11.0	4.5	3.6	4.9	4.8	5.2	5.2	7.5	6.1	6.5	5.7	7.4	4.0	5.5	4.6- 4.9
11.1-12.0	5.0	4.6	4.0	3.4	5.3	5.6	6.4	6.2	5.3	5.6	8.3	3.4	5.3	5.0- 5.4
12.1-13.0	4.4	4.4	4.4	5.3	5.7	5.7	5.2	5.3	3.5	5.4	6.2	4.0	4.9	5.5- 5.8
13.1-14.0	5.5	3.3	4.2	4.1	4.9	5.2	5.6	4.4	3.5	5.5	8.0	1.3	4.5	5.9- 6.3
14.1-15.0	5.7	4.0	4.9	3.4	4.9	4.0	5.3	3.6	2.6	4.8	4.9	2.2	4.2	6.4- 6.7
15.1-16.0	6.3	4.1	3.3	4.3	5.5	3.8	4.2	3.7	2.7	4.9	5.9	3.4	4.2	6.8- 7.2
16.1-17.0	4.3	4.6	4.2	4.9	3.9	3.4	4.1	4.3	2.4	4.3	2.2	2.8	3.8	7.3- 7.6
17.1-18.0	5.3	4.1	3.1	2.7	3.8	3.8	1.5	3.1	2.2	2.7	4.9	2.5	3.2	7.7- 8.0
18.1-19.0	3.8	4.3	4.5	3.6	2.7	2.4	2.3	3.4	1.5	4.1	4.0	3.1	3.1	8.1- 8.5
19.1-20.0	3.3	4.3	3.3	2.0	2.3	3.8	1.2	2.4	1.2	3.0	2.5	2.2	2.6	8.6- 8.9
20.1-25.0	14.8	17.8	13.6	21.1	8.1	10.2	4.9	8.9	6.3	9.4	12.0	14.4	10.7	9.0-11.2
25.1-30.0	8.4	11.2	7.0	7.3	2.5	2.0	1.0	1.9	2.3	2.4	4.3	7.7	4.3	11.3-13.4
30.1-35.0	4.5	3.5	2.9	2.4	1.0	0.6	0.2	1.1	1.0	1.1	1.2	3.1	1.8	13.5-15.6
35.1-40.0	2.0	2.1	1.1	1.2	1.1	0.0	0.2	0.8	0.4	0.5	1.2	1.6	0.9	15.7-17.9
>40.0	0.7	0.7	1.1	0.5	0.3	0.0	0.1	0.4	0.1	0.2	0.6	2.1	0.4	>17.9
AVERAGE SPEED (MPH)	16.5	16.8	14.8	15.5	12.1	11.7	10.6	11.5	9.6	12.4	14.3	14.4	12.9	
AVERAGE SPEED (M/SEC)	7.4	7.5	6.6	6.9	5.4	5.2	4.7	5.1	4.3	5.6	6.4	6.4	5.8	
AVERAGE WIND POWER (WATTS/M**2)	763.9	818.1	677.1	622.3	361.0	287.0	205.7	353.8	257.3	355.2	490.4	716.9	453.6	
PERCENT DATA RECOVERY	38.6	40.8	38.0	16.3	52.6	39.2	34.3	48.1	78.2	55.5	11.3	22.6	39.5	

ANEMOMETER HEIGHT = 4 METERS = 13 FEET

NUMBER OF OBSERVATIONS = 16048

PERCENTAGE DATA RECOVERY = 39.5

SOURCE: GEORESEARCH, INC.

Table IV - 141
Percentage Frequency Summary for Wind Speed
ROSEBUD COUNTY - COLSTRIP BN (WINTER)

01/01/75 - 08/22/79

	CALM	WIND SPEED (MPH)																AV SPEED (MPH)	AV SPEED (M/SEC)
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0			
		0.1- 0.9	0.0- 1.8	1.8- 2.7	2.7- 3.6	3.6- 4.5	4.5- 5.4	5.4- 6.3	6.3- 7.2	7.2- 8.0	8.1- 8.9	9.0- 11.2	11.2- 13.4	13.5- 15.6	15.7- 17.9	>17.9			
	1	0.0	0.0	2.8	4.9	6.3	8.4	7.0	11.2	7.7	9.8	10.5	16.8	9.8	0.7	2.8	1.4	16.5	7.4
	2	0.0	0.7	2.1	8.3	6.2	6.2	6.2	7.6	14.5	13.1	4.1	17.9	7.6	2.8	0.7	2.1	16.2	7.2
	3	0.0	0.0	2.8	8.3	2.8	7.6	7.6	11.1	11.8	9.0	11.8	16.7	6.9	2.1	1.4	0.0	15.6	7.0
	4	0.0	0.0	4.2	4.2	7.6	4.9	15.3	7.6	8.3	9.0	6.3	18.8	9.7	3.5	0.7	0.0	15.9	7.1
	5	0.0	0.0	4.9	3.5	6.3	8.4	7.7	8.4	10.5	9.1	8.4	21.7	9.1	1.4	0.7	0.0	15.9	7.1
	6	0.0	0.7	2.1	4.3	8.6	7.1	7.1	11.4	5.7	8.6	7.9	21.4	9.3	3.6	1.4	0.7	16.8	7.5
	7	0.0	0.7	2.1	8.6	6.4	5.0	10.7	4.3	10.0	10.0	5.0	18.6	12.1	3.6	2.9	0.0	16.8	7.5
	8	0.0	0.7	4.3	5.0	10.6	7.1	6.4	5.7	11.3	7.8	5.0	14.2	12.1	6.4	3.5	0.0	16.8	7.5
H	9	0.0	2.1	4.2	7.0	5.6	8.5	9.9	8.5	7.7	7.7	4.2	14.1	16.2	2.8	1.4	0.0	16.0	7.2
O	10	0.0	2.1	2.8	9.9	5.6	9.9	9.2	6.3	7.0	4.9	9.9	15.5	9.9	3.5	3.5	0.0	15.8	7.1
U	11	0.0	1.4	3.5	7.0	7.7	4.9	10.5	14.7	4.9	4.9	7.0	16.1	6.3	6.3	3.5	1.4	16.6	7.4
U	12	0.0	0.7	2.8	11.9	9.1	6.3	9.8	8.4	6.3	4.2	7.7	11.2	9.8	6.3	3.5	2.1	16.5	7.4
R	13	0.0	1.4	5.6	8.3	6.9	6.3	9.7	9.7	4.2	8.3	6.3	11.8	9.0	6.3	4.2	2.1	16.6	7.4
R	14	0.0	0.0	3.4	11.6	8.8	8.8	5.4	7.5	6.8	6.8	9.5	10.9	8.2	7.5	4.1	0.7	16.3	7.3
R	15	0.0	0.0	6.1	6.1	10.1	10.8	6.8	5.4	8.8	8.1	4.1	14.9	8.1	5.4	2.7	2.7	16.4	7.3
R	16	0.0	0.0	5.4	7.5	3.4	9.5	8.2	7.5	10.2	10.2	6.1	10.2	12.9	4.8	1.4	2.7	16.8	7.5
R	17	0.0	0.7	2.7	4.8	5.4	10.2	7.5	10.9	13.6	3.4	7.5	14.3	11.6	4.1	2.0	1.4	16.7	7.5
R	18	0.0	1.3	3.4	5.4	8.7	4.0	12.8	8.1	10.7	8.7	8.1	16.1	5.4	5.4	2.0	0.0	15.8	7.1
R	19	0.0	0.7	2.0	7.3	12.0	8.0	10.0	7.3	7.3	6.7	10.7	16.0	7.3	3.3	0.7	0.7	15.3	6.8
R	20	0.0	0.7	5.3	4.0	8.0	11.3	8.7	6.0	10.0	8.0	6.7	18.0	8.0	4.0	0.0	1.3	15.5	6.9
R	21	0.0	0.0	4.7	2.7	8.1	10.7	8.7	6.0	10.7	10.7	8.1	16.1	9.4	2.0	1.3	0.7	16.0	7.1
R	22	0.0	0.7	2.7	6.8	7.4	6.8	10.8	6.8	10.8	10.1	5.4	18.2	10.8	0.7	0.7	1.4	15.7	7.0
R	23	0.0	0.7	2.7	6.7	6.7	9.4	7.4	8.1	12.8	8.7	6.7	16.8	10.1	1.3	0.7	1.3	16.0	7.1
R	24	0.0	0.0	2.0	5.4	9.4	10.1	3.4	8.1	8.7	14.1	9.4	16.1	6.7	4.7	1.3	0.7	16.4	7.3
	ALL HOURS	0.0	0.6	3.5	6.6	7.4	7.9	8.6	8.2	9.2	8.4	7.3	15.9	9.4	3.8	2.0	1.0	16.2	7.2

SOURCE: GEORESEARCH, INC.

Table IV - 142
Percentage Frequency Summary for Wind Speed
ROSEBUD COUNTY - COLSTRIP BN (SPRING)

01/01/75 - 08/22/79

	CALM	WIND SPEED (MPH)															AV SPEED (MPH)	AV SPEED (M/SEC)	
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0			
		0.1- 0.9	0.0- 1.8	1.8- 2.7	2.7- 3.6	3.6- 4.5	4.5- 5.4	5.4- 6.3	6.3- 7.2	7.2- 8.0	8.1- 8.9	9.0- 11.2	11.2- 13.4	13.5- 15.6	15.7- 17.9	>17.9			
H	1	0.0	1.2	5.5	7.3	7.9	10.3	13.9	12.7	10.3	6.1	6.1	11.5	3.6	1.8	1.8	0.0	13.4	6.0
	2	0.0	0.0	6.1	9.7	6.7	12.7	8.5	13.3	10.3	9.7	5.5	11.5	1.8	1.8	2.4	0.0	13.5	6.0
	3	0.0	0.6	5.5	9.1	10.3	12.7	11.5	11.5	10.3	7.9	3.6	12.7	0.6	3.0	0.0	0.6	12.7	5.7
	4	0.0	0.6	4.8	12.1	10.3	15.2	9.1	9.7	10.3	6.7	4.2	10.9	4.2	0.6	0.6	0.6	12.6	5.6
	5	0.0	0.0	6.0	12.7	12.0	12.7	8.4	9.0	7.8	7.8	4.8	12.7	3.0	1.2	1.2	0.6	12.7	5.7
	6	0.0	0.0	4.8	12.7	13.9	7.8	10.2	9.0	10.8	5.4	6.6	13.3	1.8	3.0	0.0	0.6	13.0	5.8
	7	0.0	0.0	7.3	10.9	11.5	11.5	9.7	5.5	7.3	7.3	10.9	10.3	4.8	1.8	0.0	1.2	13.4	6.0
	8	0.0	0.0	4.3	14.0	11.0	12.2	6.1	9.1	9.8	7.3	6.1	11.0	5.5	1.2	1.2	1.2	13.5	6.0
	9	0.0	0.0	6.7	10.4	11.6	12.2	8.5	10.4	7.9	6.1	4.3	11.0	6.7	1.2	1.2	1.2	13.5	6.0
	10	0.0	0.0	3.7	9.2	12.9	13.5	11.7	9.2	7.4	4.9	7.4	10.4	5.5	1.2	1.2	1.2	13.8	6.2
	11	0.0	0.0	4.9	9.3	9.3	14.8	9.3	9.3	9.9	6.8	6.8	10.5	5.6	3.1	0.0	0.6	13.6	6.1
	12	0.0	0.0	3.7	9.1	9.8	11.6	10.4	8.5	12.2	6.1	6.1	11.6	7.3	1.8	0.0	1.8	14.5	6.5
	13	0.0	1.2	1.8	8.4	10.2	7.8	12.0	9.0	13.3	4.8	8.4	12.0	7.2	1.2	1.8	0.6	14.4	6.4
	14	0.0	0.0	3.0	7.8	10.8	10.2	9.0	10.2	9.6	10.8	4.2	15.7	5.4	1.8	1.2	0.0	14.3	6.4
	15	0.0	0.0	1.8	8.5	11.5	12.1	9.7	6.7	9.7	6.7	9.7	13.9	4.8	3.0	1.8	0.0	14.5	6.5
	16	0.0	0.0	0.6	8.5	10.9	12.1	6.7	8.5	11.5	9.1	7.3	13.3	7.9	1.8	1.2	0.6	14.9	6.6
	17	0.0	0.6	1.2	7.9	8.5	17.1	8.5	8.5	5.5	13.4	6.1	13.4	4.9	2.4	1.8	0.0	14.5	6.5
	18	0.0	0.0	1.2	7.9	10.9	13.9	10.9	8.5	8.5	7.3	5.5	17.0	4.8	2.4	0.6	0.6	14.4	6.4
	19	0.0	1.2	6.0	6.0	10.2	16.9	9.6	9.6	6.6	7.8	4.8	13.3	4.8	1.8	0.6	0.6	13.3	5.9
	20	0.0	0.0	4.8	11.4	14.5	12.7	11.4	8.4	5.4	9.6	3.0	11.4	4.2	1.8	0.6	0.6	12.6	5.6
	21	0.0	0.6	4.8	11.4	12.7	12.7	8.4	10.2	10.8	5.4	4.8	9.6	4.8	1.8	1.2	0.6	12.8	5.7
	22	0.0	1.2	4.8	9.1	13.9	13.3	9.7	8.5	6.1	7.3	5.5	10.9	6.1	1.8	1.2	0.6	13.3	5.9
	23	0.0	0.0	7.3	9.1	9.8	11.6	4.9	13.4	9.1	6.7	8.5	12.2	3.7	2.4	1.2	0.0	13.4	6.0
	24	0.0	0.6	7.3	7.9	7.3	8.5	12.1	13.9	9.7	11.5	4.8	7.3	6.1	1.2	1.8	0.0	13.5	6.0
ALL HOURS		0.0	0.3	4.5	9.6	10.8	12.3	9.6	9.7	9.2	7.6	6.0	12.0	4.8	1.9	1.1	0.6	13.6	6.1

SOURCE: GEORESEARCH, INC.

Table IV - 143
Percentage Frequency Summary for Wind Speed
ROSEBUD COUNTY - COLSTRIP BN (SUMMER)
01/01/75 - 08/22/79

	CALM	WIND SPEED (MPH)															AV (MPH)	AV (M/SEC)	
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0			
	CALM	WIND SPEED (M/SEC)																	
1	0.0	4.4	7.7	5.5	12.1	9.9	17.6	14.3	7.1	6.0	4.9	6.6	2.2	1.6	0.0	0.0	11.4	5.1	
2	0.5	4.4	7.7	8.2	12.6	15.3	10.9	9.3	10.9	5.5	6.6	4.9	2.2	0.5	0.5	0.0	11.0	4.9	
3	0.5	4.4	8.2	9.8	10.4	16.4	9.8	9.8	9.3	7.7	3.3	6.6	2.2	1.1	0.5	0.0	11.0	4.9	
4	0.5	4.9	6.6	9.8	13.1	13.1	10.4	13.1	9.3	6.6	3.3	7.1	2.2	0.0	0.0	0.0	10.7	4.8	
5	0.6	4.4	3.9	11.6	13.8	14.4	14.4	9.9	7.7	5.5	4.4	6.1	2.8	0.6	0.0	0.0	10.9	4.9	
6	0.6	3.3	6.6	15.5	11.6	12.7	11.0	13.3	5.5	4.4	5.0	8.8	1.7	0.0	0.0	0.0	10.5	4.7	
7	0.6	3.9	7.7	13.8	19.3	9.4	13.3	8.3	2.8	5.0	5.5	9.4	1.1	0.0	0.0	0.0	10.1	4.5	
8	0.6	5.0	10.5	11.6	11.0	12.2	12.2	9.4	7.2	3.9	7.2	8.3	0.6	0.6	0.0	0.0	10.3	4.6	
H	9	1.1	3.8	8.2	15.4	12.6	9.9	9.3	7.7	8.8	6.6	4.9	8.2	2.2	0.5	0.0	10.9	4.9	
O	10	1.1	3.8	8.7	5.5	21.9	11.5	10.9	5.5	7.1	7.1	5.5	8.7	1.1	1.1	0.5	0.0	11.0	4.9
U	11	1.1	3.8	3.8	12.0	14.7	14.7	12.0	6.0	6.0	7.1	4.9	10.3	2.2	1.1	0.5	0.0	11.4	5.1
R	12	0.5	2.7	4.4	12.1	11.5	17.0	9.9	9.9	7.1	4.9	8.2	8.8	2.2	0.0	0.0	0.5	11.4	5.1
	13	0.0	3.9	2.2	11.6	11.6	18.2	9.9	8.8	8.3	8.3	5.5	10.5	0.6	0.0	0.0	0.6	11.6	5.2
	14	1.1	3.3	0.5	10.9	15.2	13.0	15.2	9.8	7.1	6.0	3.8	13.0	0.5	0.0	0.5	0.0	11.5	5.1
	15	0.0	2.7	3.8	6.6	16.9	15.3	10.4	14.2	7.7	4.9	6.6	8.7	0.5	1.1	0.5	0.0	11.6	5.2
	16	0.0	4.3	2.2	11.4	12.5	10.9	8.2	16.8	10.3	8.2	3.8	9.2	0.5	1.1	0.5	0.0	11.7	5.2
	17	1.1	2.7	2.7	10.9	11.5	12.6	14.8	10.4	9.8	7.7	6.6	6.0	1.1	0.5	1.1	0.5	11.8	5.3
	18	1.6	2.2	3.8	14.1	8.7	7.6	15.2	10.9	9.8	7.6	7.1	7.1	2.2	0.5	1.1	0.5	12.1	5.4
	19	0.5	3.8	2.2	12.0	9.8	12.0	13.1	8.2	6.6	9.8	6.0	12.6	0.5	2.2	0.0	0.5	12.4	5.5
	20	0.5	2.2	4.9	7.1	13.7	15.4	9.3	9.9	9.3	10.4	4.9	7.1	3.3	0.0	1.6	0.0	12.1	5.4
	21	0.0	3.3	3.9	9.4	11.1	15.6	15.0	10.6	7.8	9.4	3.3	8.3	1.7	0.6	0.0	0.0	11.5	5.1
	22	1.1	3.3	6.1	6.1	7.7	18.2	15.5	11.0	11.6	3.9	6.6	6.1	1.7	1.1	0.0	0.0	11.4	5.1
	23	0.6	3.3	5.0	5.0	8.3	21.0	12.7	11.6	9.9	7.7	3.3	8.3	1.7	1.1	0.0	0.6	11.8	5.3
	24	1.1	3.8	7.1	5.5	9.3	15.9	14.8	11.5	7.1	8.8	4.4	4.9	3.3	1.1	1.1	0.0	11.8	5.3
ALL HOURS		0.6	3.7	5.3	10.1	12.6	13.8	12.3	10.4	8.1	6.8	5.2	8.2	1.7	0.7	0.4	0.2	11.3	5.1

SOURCE: GEORESEARCH, INC.

Table IV - 144
Percentage Frequency Summary for Wind Speed
ROSEBUD COUNTY - COLSTRIP BN (AUTUMN)
01/01/75 - 08/22/79

	CALM	WIND SPEED (MPH)																AV SPEED (MPH)	AV SPEED (M/SEC)
		0.1- 2.0	2.1- 4.0	4.1- 6.0	6.1- 8.0	8.1- 10.0	10.1- 12.0	12.1- 14.0	14.1- 16.0	16.1- 18.0	18.1- 20.0	20.1- 25.0	25.1- 30.0	30.1- 35.0	35.1- 40.0	>40.0			
		0.1- 0.9	0.0- 1.8	1.8- 2.7	2.7- 3.6	3.6- 4.5	4.5- 5.4	5.4- 6.3	6.3- 7.2	7.2- 8.0	8.1- 8.9	9.0- 11.2	11.2- 13.4	13.5- 15.6	15.7- 17.9	>17.9			
H	1	2.9	6.3	2.3	5.1	14.3	13.1	13.1	14.3	4.6	9.7	3.4	8.6	2.3	0.0	0.0	0.0	11.1	4.9
O	2	2.8	6.8	3.4	7.9	11.3	15.8	14.1	7.3	5.6	7.3	5.6	9.0	2.8	0.0	0.0	0.0	11.0	4.9
U	3	1.7	6.2	5.1	10.2	13.0	9.0	9.0	11.9	6.2	8.5	4.0	11.9	2.3	0.6	0.0	0.6	11.6	5.2
R	4	2.9	5.7	3.4	10.9	8.6	13.7	12.0	9.1	9.1	5.1	6.3	8.6	2.9	0.0	1.1	0.6	11.6	5.2
	5	3.4	4.5	3.4	11.9	13.6	11.4	14.2	6.8	5.7	6.3	7.4	6.3	2.8	1.1	0.6	0.6	11.1	5.0
	6	3.4	4.0	5.1	9.1	12.6	16.0	9.7	9.7	4.0	8.6	6.9	5.7	3.4	0.0	0.6	1.1	11.5	5.2
	7	4.0	4.0	4.6	9.1	16.0	14.3	12.0	8.0	6.9	6.3	4.0	9.1	0.0	1.1	0.0	0.6	10.7	4.8
	8	3.4	5.7	5.7	10.8	11.4	11.9	15.3	8.5	9.1	2.3	4.0	8.0	1.7	1.1	0.6	0.6	10.8	4.8
	9	2.3	6.8	9.6	6.8	8.5	16.4	7.3	13.0	7.3	6.2	6.2	5.1	1.7	1.7	1.1	0.0	10.9	4.9
	10	2.8	5.6	9.0	7.3	13.6	9.6	11.9	6.8	9.0	6.2	6.8	6.2	1.7	2.3	1.1	0.0	11.1	5.0
	11	3.4	4.5	6.2	10.7	13.6	14.7	9.6	7.9	5.1	6.8	4.5	7.9	2.3	2.8	0.0	0.0	11.0	4.9
	12	1.1	7.3	3.9	11.2	16.9	14.0	7.9	8.4	5.1	3.4	3.9	12.4	1.1	3.4	0.0	0.0	11.0	4.9
	13	1.1	6.8	6.2	11.9	13.6	11.3	10.7	7.3	6.2	3.4	4.0	11.9	2.3	2.3	1.1	0.0	11.3	5.1
	14	1.1	8.5	4.0	13.6	10.7	12.4	6.2	9.6	6.8	4.0	6.8	10.7	2.3	2.3	1.1	0.0	11.6	5.2
	15	1.1	8.5	5.1	11.3	7.3	11.9	7.3	10.7	9.6	5.6	4.5	9.6	3.4	2.3	1.1	0.6	12.1	5.4
	16	0.6	8.5	4.5	10.2	10.2	9.7	11.9	7.4	9.1	6.8	4.0	10.2	3.4	1.1	2.3	0.0	12.2	5.4
	17	1.1	6.8	4.5	10.8	9.1	15.3	11.9	9.1	8.5	5.7	4.0	5.7	5.1	1.1	1.1	0.0	11.5	5.1
	18	2.3	5.6	5.6	13.0	13.0	10.7	11.3	9.6	9.0	5.1	3.4	7.3	2.3	1.7	0.0	0.0	10.7	4.8
	19	4.0	5.1	5.1	11.9	10.7	16.4	15.8	9.6	7.3	1.1	3.4	5.6	4.0	0.0	0.0	0.0	10.1	4.5
	20	1.1	8.4	2.2	12.9	14.6	14.6	14.0	7.3	8.4	4.5	3.4	5.6	2.2	0.6	0.0	0.0	10.1	4.5
	21	2.3	5.6	4.0	9.6	17.5	12.4	14.1	9.6	6.8	6.8	4.0	5.1	2.3	0.0	0.0	0.0	10.2	4.6
	22	2.9	4.6	5.7	9.7	12.6	13.7	15.4	7.4	9.7	5.1	5.7	6.3	1.1	0.0	0.0	0.0	10.3	4.6
	23	2.3	5.7	4.6	6.9	9.8	16.7	17.2	7.5	9.8	6.3	2.3	7.5	3.4	0.0	0.0	0.0	10.9	4.9
	24	1.7	8.0	4.6	5.7	11.5	12.1	14.4	10.9	9.2	7.5	5.2	6.3	2.9	0.0	0.0	0.0	10.9	4.9
	ALL HOURS	2.3	6.2	4.9	10.0	12.2	13.2	11.9	9.1	7.4	5.8	4.7	7.9	2.5	1.1	0.5	0.2	11.0	4.9

SOURCE: GEORESEARCH, INC.

Table IV - 145
Annual Wind Rose Distribution
ROSEBUD COUNTY - COLSTRIP BN
01/01/75 - 08/22/79

DIRECTION>	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL	<DIRECTION	SPEED (M/SEC)
	SPEED (MPH)																		
	0.1- 1.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.1	0.1	0.2	1.4	0.1- 0.4	
	1.1- 2.0	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	1.1	0.5- 0.9	
	2.1- 3.0	0.2	0.1	0.1	0.1	0.2	0.3	0.1	0.1	0.3	0.2	0.1	0.1	0.2	0.1	0.1	2.6	1.0- 1.3	
	3.1- 4.0	0.3	0.1	0.1	0.2	0.2	0.3	0.1	0.3	0.6	0.3	0.1	0.2	0.2	0.3	0.1	3.5	1.4- 1.8	
S	4.1- 5.0	0.4	0.3	0.2	0.4	0.3	0.5	0.3	0.4	0.6	0.4	0.1	0.3	0.2	0.4	0.1	4.9	1.9- 2.2	
P	5.1- 6.0	0.5	0.3	0.1	0.5	0.4	0.6	0.3	0.5	0.5	0.4	0.1	0.3	0.3	0.2	0.3	5.5	2.3- 2.7	
E	6.1- 7.0	0.5	0.2	0.1	0.4	0.4	0.6	0.3	0.4	0.3	0.5	0.1	0.3	0.3	0.4	0.2	5.4	2.8- 3.1	
E	7.1- 8.0	0.4	0.2	0.1	0.3	0.4	0.8	0.4	0.5	0.5	0.4	0.2	0.4	0.3	0.5	0.3	6.1	3.2- 3.6	
D	8.1- 9.0	0.4	0.2	0.1	0.4	0.4	0.9	0.4	0.5	0.4	0.3	0.2	0.5	0.3	0.7	0.3	6.2	3.7- 4.0	
M	9.1-10.0	0.4	0.2	0.1	0.3	0.4	0.9	0.3	0.4	0.4	0.5	0.2	0.5	0.4	0.5	0.3	5.8	4.1- 4.5	
M	10.1-11.0	0.3	0.1	0.1	0.2	0.3	0.7	0.2	0.3	0.4	0.5	0.2	0.6	0.4	0.6	0.3	5.5	4.6- 4.9	
I	11.1-12.0	0.3	0.1	0.0	0.2	0.2	0.7	0.1	0.2	0.4	0.4	0.2	0.7	0.5	0.5	0.3	5.2	5.0- 5.4	
L	12.1-13.0	0.2	0.1	0.0	0.1	0.2	0.6	0.2	0.2	0.2	0.5	0.2	0.5	0.6	0.6	0.2	4.7	5.5- 5.8	
E	13.1-14.0	0.2	0.0	0.0	0.1	0.2	0.6	0.1	0.2	0.2	0.4	0.1	0.6	0.4	0.7	0.3	4.6	5.9- 6.3	
S	14.1-15.0	0.2	0.0	0.0	0.1	0.1	0.5	0.1	0.1	0.2	0.5	0.1	0.5	0.6	0.7	0.3	4.3	6.4- 6.7	
/	15.1-16.0	0.1	0.0	0.0	0.0	0.1	0.5	0.1	0.1	0.2	0.5	0.1	0.5	0.5	0.7	0.3	4.1	6.8- 7.2	
H	16.1-17.0	0.1	0.0	0.0	0.0	0.1	0.4	0.1	0.1	0.1	0.3	0.1	0.5	0.6	0.7	0.2	3.5	7.3- 7.6	
O	17.1-18.0	0.2	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.1	0.3	0.0	0.4	0.8	0.7	0.2	3.4	7.7- 8.0	
U	18.1-19.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.3	0.0	0.4	0.5	0.6	0.2	2.7	8.1- 8.5	
R	19.1-20.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.1	0.1	0.2	0.0	0.3	0.6	0.7	0.2	2.8	8.6- 8.9	
	20.1-25.0	0.1	0.1	0.1	0.0	0.1	0.8	0.1	0.1	0.2	0.3	0.1	1.2	1.8	2.1	0.7	0.9	8.8	9.0-11.2
	25.1-30.0	0.0	0.1	0.1	0.0	0.0	0.3	0.0	0.1	0.0	0.0	0.0	0.4	1.0	1.3	0.4	0.6	4.5	11.3-13.4
	30.1-35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.7	0.2	0.3	1.8	13.5-15.6
	35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.2	0.9	15.7-17.9
	>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.5	>17.9	
	CALM															0.1	CALM		
	TOTAL	5.2	2.2	1.2	3.5	4.1	11.0	3.5	4.7	6.2	7.3	2.3	9.6	11.2	14.4	5.6	7.7	100.0	TOTAL
AV SPD (MPH)		9.9	9.9	12.1	8.6	9.1	11.8	10.0	9.5	9.6	11.4	10.7	14.3	17.2	17.1	15.7	15.3	13.2	AV SPD (MPH)
AV SPD (M/S)		4.4	4.4	5.4	3.9	4.1	5.3	4.4	4.3	4.3	5.1	4.8	6.4	7.7	7.6	7.0	6.8	5.9	AV SPD (M/S)

SOURCE: GEORESEARCH, INC.

Figure IV - 16
Annual Wind Rose
COLSTRIP BN — ROSEBUD COUNTY
(1975 - 1978)

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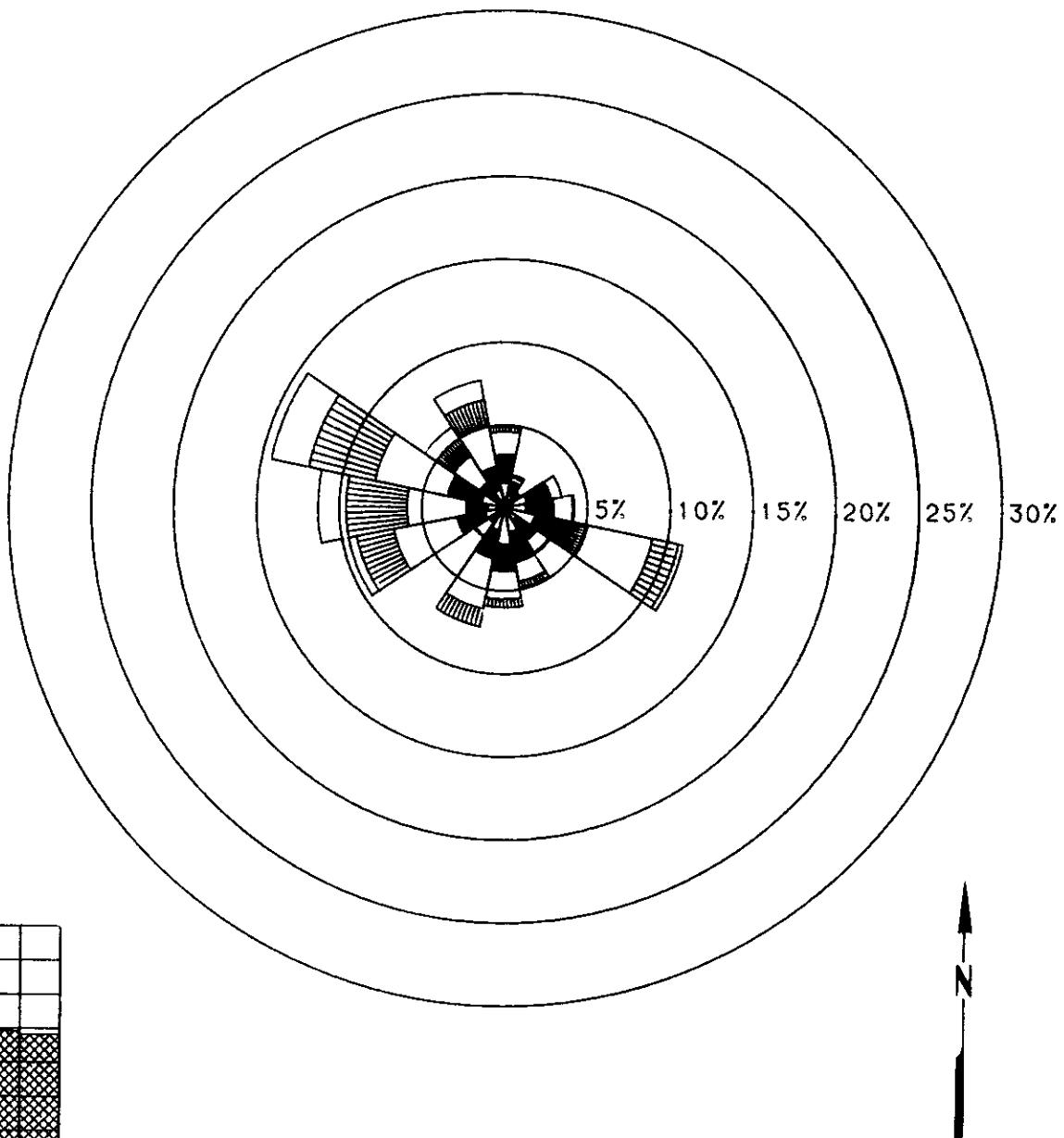
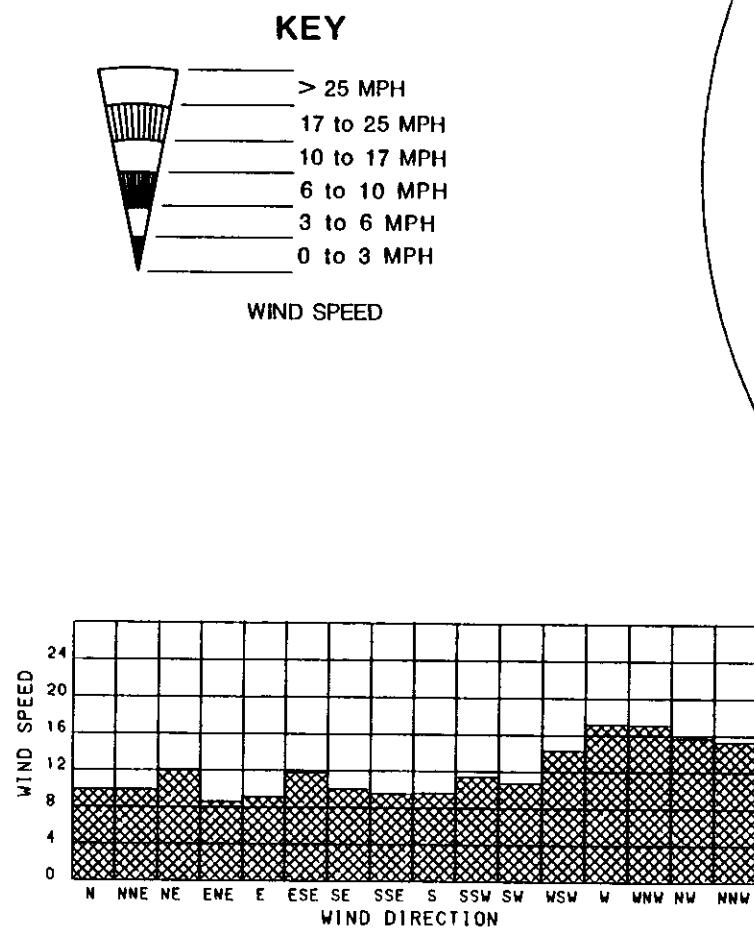


Table IV - 146
Coefficients of Weibull Distribution
ROSEBUD COUNTY - COLSTRIP BN

01/01/75 - 08/22/79

MONTH	SCALE FACTOR (C) (M/SEC)	SHAPE FACTOR (K)
JANUARY	8.1857	2.2640
FEBRUARY	8.7885	2.0113
MARCH	7.2949	1.8616
APRIL	7.8658	1.8903
MAY	5.9276	1.9930
JUNE	5.9357	1.8730
JULY	5.1494	2.2689
AUGUST	6.4472	1.6983
SEPTEMBER	5.4611	1.1807
OCTOBER	6.2151	2.0368
NOVEMBER	6.5962	2.5135
DECEMBER	6.8713	1.4632
YEAR	6.4642	1.8210

SOURCE: GEORESEARCH, INC.

WESTERN ENERGY #12

ROSEBUD COUNTY

The Western Energy #12 air monitoring site was established by Western Energy Company to monitor particulate concentrations around their mine. The site is located approximately 1 mile south of Colstrip at 45°52'06" N and 106°38'27" W (Site No. 114 on Map II-1). Elevation at the site is 3,280 feet.

Wind data have been gathered at this site since January 1, 1981. Data through March 15, 1982, were available for analysis. The data set consists of hourly averages of wind speed and wind direction collected at an anemometer height of 10 meters above ground level. Data recovery was excellent, ranging from 77.6 percent in March to 98.6 percent in June and November. Overall data recovery was 91.5 percent.

Average annual wind speed was 7.3 miles per hour. Average monthly wind speeds varied from 5.9 miles per hour in November to 9.3 miles per hour in May. The windiest months were April through June.

Average monthly wind power ranged from 27.3 watts/m² in November to 79.1 watts/m² in May. Average annual wind power was 48.4 watts/m².

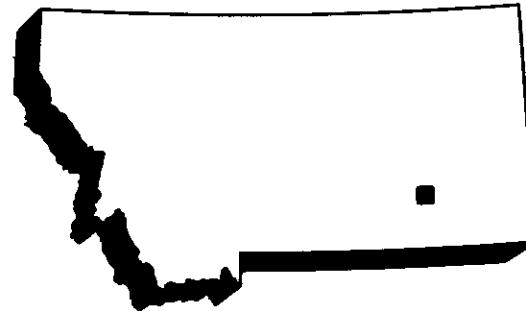


Table IV - 147

Monthly Wind Speed Distribution

ROSEBUD COUNTY - WESTERN ENERGY #12

01/01/81 - 03/15/82

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	0.2	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	CALM
0.1-1.0	2.7	5.3	3.7	1.1	1.9	0.6	0.7	0.5	0.7	1.5	1.0	2.8	2.1	0.1- 0.4
1.1-2.0	5.9	5.1	5.4	1.9	2.8	4.2	3.3	3.0	2.9	4.4	6.2	7.7	4.5	0.5- 0.9
2.1-3.0	8.5	6.6	5.5	4.7	3.2	5.4	8.5	8.4	8.5	7.0	12.4	11.1	7.5	1.0- 1.3
3.1-4.0	10.8	8.5	10.5	9.0	6.1	7.2	10.7	14.6	12.9	12.4	17.7	13.1	10.9	1.4- 1.8
4.1-5.0	15.4	10.8	10.3	8.4	8.5	11.0	12.2	18.2	15.6	12.1	15.6	11.9	12.6	1.9- 2.2
5.1-6.0	12.1	10.0	16.0	10.1	8.7	9.4	14.8	13.1	13.2	9.5	12.0	9.6	11.6	2.3- 2.7
6.1-7.0	8.8	7.5	8.9	8.0	7.0	8.5	10.4	11.8	10.3	8.8	7.5	8.5	8.7	2.8- 3.1
7.1-8.0	5.8	7.1	8.1	7.8	7.9	8.6	10.2	7.2	8.5	7.3	5.1	6.9	7.4	3.2- 3.6
8.1-9.0	4.4	6.6	6.9	6.3	7.1	5.9	6.8	6.5	4.6	5.4	3.0	3.1	5.5	3.7- 4.0
9.1-10.0	4.5	5.0	4.8	3.8	4.7	7.0	5.9	3.0	3.9	6.0	3.1	4.0	4.7	4.1- 4.5
10.1-11.0	3.2	4.6	2.9	3.6	6.7	6.5	4.5	3.0	3.5	5.2	2.7	4.0	4.1	4.6- 4.9
11.1-12.0	3.0	3.0	4.2	5.4	6.0	4.5	3.6	2.6	3.2	4.0	3.1	3.2	3.7	5.0- 5.4
12.1-13.0	2.7	3.8	4.2	6.4	5.5	3.1	2.3	2.8	3.8	4.7	2.7	2.2	3.6	5.5- 5.8
13.1-14.0	2.2	3.5	2.5	5.0	4.4	2.8	2.0	1.7	2.5	2.9	3.4	2.8	2.9	5.9- 6.3
14.1-15.0	1.2	2.8	1.3	4.1	4.5	3.4	1.0	0.8	2.0	2.7	1.4	3.5	2.3	6.4- 6.7
15.1-16.0	1.5	2.5	1.6	3.6	3.4	2.8	0.7	0.5	1.9	1.1	1.0	1.7	1.9	6.8- 7.2
16.1-17.0	1.7	1.5	1.3	3.6	3.8	1.8	0.6	0.2	1.0	1.2	0.8	0.5	1.5	7.3- 7.6
17.1-18.0	1.2	1.7	0.7	1.6	2.2	2.1	0.3	0.3	0.7	1.2	0.7	0.6	1.2	7.7- 8.0
18.1-19.0	0.8	0.9	0.7	1.9	1.6	1.4	0.3	0.2	0.1	0.8	0.7	0.3	0.8	8.1- 8.5
19.1-20.0	0.9	1.2	0.1	1.6	1.0	0.7	0.1	0.6	0.3	0.3	0.0	0.6	0.7	8.6- 8.9
20.1-25.0	2.0	1.4	0.1	1.9	2.9	2.8	0.9	0.6	0.0	1.5	0.0	1.4	1.3	9.0-11.2
25.1-30.0	0.4	0.3	0.0	0.4	0.0	0.3	0.1	0.5	0.0	0.0	0.0	0.3	0.2	11.3-13.4
30.1-35.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	13.5-15.6
35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.7-17.9
>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>17.9
AVERAGE SPEED (MPH)	6.9	7.5	6.7	9.0	9.3	8.4	6.7	6.3	6.7	7.4	5.9	6.6	7.3	
AVERAGE SPEED (M/SEC)	3.1	3.4	3.0	4.0	4.1	3.8	3.0	2.8	3.0	3.3	2.7	3.0	3.3	
AVERAGE WIND POWER (WATTS/M**2)	54.1	56.9	34.7	76.2	79.1	65.4	31.2	29.2	30.8	46.8	27.3	48.8	48.4	
PERCENT DATA RECOVERY	93.0	88.1	77.6	97.5	92.2	98.6	93.3	86.3	96.1	97.9	98.6	87.2	91.5	

ANEMOMETER HEIGHT = 10 METERS = 33 FEET

NUMBER OF OBSERVATIONS = 9638

PERCENTAGE DATA RECOVERY = 91.5

SOURCE: GEORESEARCH, INC.